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No. 73

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THE FOKKER "UNIVERSAL" COMMERCIAL AIRPLANE

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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

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AIRCRAFT CIRCULAR NO. 73.

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THE FOKKER "UNIVERSAL" COMMERCIAL AIRPLANE.\*

The Fokker "Universal" airplane is a high-wing monoplane fitted with a Wright "Whirlwind" 200-230 HP. engine and is designed to carry from four to six passengers. It can be equipped with floats or wheels very readily as the interchanging is done without altering the fixed structure in any way. The general design and appearance of the airplane is shown in Figures 1 and 2.

The wings seldom need recovering, and can be flown safely even when damaged, with large holes and considerable breakage, as the veneer cannot "balloon," being nailed and glued to every stringer, rib and spar. The veneer covering provides both structural strength and stiffness, and avoids all possibility of twisting or fluttering of the wing tips. The wings are braced by one pair of steel tube struts, of streamline section on each side. The front strut is attached to a detachable steel tube tripod structure on the side of the fuselage, on which the landing gear vertical struts also abut. They do not obstruct the view from either cabin or cockpit.

The wing is normally built in one piece, as it is only 47 feet long. Assembly is unusually quick and easy, as the wing is simply lifted onto the fuselage, after which the eight attachment bolts to the fuselage and struts are put in. No adjustment

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\*From a circular issued by the Atlantic Aircraft Corporation.

or truing up is necessary as the wings of this veneer-covered construction have never been known to change their shape. Hoist fittings are permanently installed on the wing, by which either the wing or the entire airplane can be hoisted.

The steel tube fuselage structure is simple and easily repairable (Fig. 3). Ordinary commercial grade tubing is used.

#### Power Plant

The 200-230 HP. Wright "Whirlwind" air-cooled radial engine is used.

The exhaust manifold consists of a sheet steel collector ring, recessed into the cowlings so as to offer minimum head resistance and is connected to the cylinders by flexible tubing and ends in a flexible exit pipe to a point below the fuselage aft of the pilot's cockpit. Contrary to other similar arrangements of the collector ring, the recess behind same is triangular in shape and opens forward, so that a stream of air is directed onto the back of the collector ring, which insures exceptional protection against the burning out of the manifold. In the rear wall of the recess, hand-operated doors are provided, through which the cockpit can be heated when desired.

Engine starters of any of the current "Eclipse" or Wright types can be fitted as special equipment without alterations to any parts.

### C o w l i n g

In the latest series of "Universals" the cowling has been greatly improved from the point of view of reducing head resistance and increasing performance. It now extends between the cylinders to form a streamline shield over the front of the engine. Care has been taken to make the proportions such that adequate cooling of the engine under all conditions is assured and also to keep the crank case sufficiently protected against chilling of the lubrication system.

No "spinner" on the propeller is used.

### Tanks and Fuel System

The two fuel tanks which have a total capacity of 78 gallons, sufficient for more than six hours' flight at cruising speed, are placed in the wing, on either side of the fuselage. More tanks can be fitted, if desired. In this position, between the big heavy wing spars, they are practically immune from damage from any cause. The two entirely separate pipe lines, provided with shut-off cocks within reach of the pilot, run on a constant slope down to the strainer, which is also placed outside the fuselage and close to the carburetor, the latter being also entirely outside. A completely fireproof and troubleproof fuel system is provided.

## V i s i o n

Closely connected with the safety of passengers is the question of vision for the pilot. Seated ahead of the leading edge of the wing, the forward, right and left, overhead, downward, and rear visions are entirely unobstructed. To the rear of each side, under the wing, the vision also extends back over a capacious angle.

### Pilot's Cockpit and Controls

The cockpit is well screened, comfortable and roomy. It is well protected by special reinforcement of the steel structure of the fuselage; "nosing over" is practically impossible owing to the forward position of the wheels, but in any event the pilot's head is protected by the wing and fuselage structure and the engine. The cockpit has been so designed that it is entered very comfortably through a large door from the cabin, as well as over the sides of the cockpit. Next to the pilot's seat is a second seat, part of which folds away when the entrance door is used. The controls are arranged in such a way that the pilot can fly the airplane from a position over towards the left side, which enables the passenger sitting next to the pilot to temporarily assume control, if desired. The control shaft and aileron cables are so arranged that the stick can be moved to a central position and the pilot sit there, if it is not desired to use the additional seat arrangement, in which case the entrance into the cabin provides good communication between the passengers and the pilot.

Stick control and rudder pedals of the straight pull swinging type are fitted. All pulleys are of bakelite, directly visible, and carefully aligned to prevent wear of the cables. The controls all work very lightly, both mechanically and in the air.

The instruments are set in a V-type dash in front of the pilot. As standard equipment, a magnetic compass, altimeter, air-speed indicator, tachometer, oil pressure gauge, oil thermometer, switch and gasoline level gauge are supplied.

### Cabin Arrangements

In view of the numerous different commercial purposes for which an airplane of this type, size, and performance, can be used, the fuselage has been laid out so as to provide the maximum unobstructed cabin space, which can be divided into passenger and freight or baggage compartments, according to individual requirements. As standard equipment, four comfortable passenger seats, with plenty of leg room, are fitted in the forward part of the cabin, behind which ample baggage space is left. If desired, however, two more seats can be fitted in this space, or a part of it can be equipped as a lavatory and toilet.

The width of the cabin is such that, contrary to most airplanes of this general size and type, there is passageway down the center of the cabin between the seats, which enables any passenger to go forward to the cockpit or back to the baggage compartment or the toilet or the door, without disturbing the others. No folding seats are used, but the comfortable bucket type

seats can be removed quickly if the space is needed for freight instead of passengers.

The standard interior finish is simple and neat, being partly carried out in imitation leather with mahogany mouldings and partly in lacquer-finished fabric, reinforced with veneer. These materials are easily cleaned and renovated. They also permit easy stripping for inspection and overhauls without destruction.

The proportions of the cabin lend themselves excellently to a conversion to an ambulance airplane. With this arrangement, two or three stretchers and seats for two attendants can be installed.

For carrying mail or express, and when specified, the whole or any part of the cabin space can be completely walled with heavy veneer or metal.

Sliding windows of ample size, made of glass, not celluloid or similar semi-opaque materials, are provided. The door is of convenient size for entry by one step from the ground. It is solidly built and will stand up under the slamming and blowing which is inevitable in hard commercial use.

The inside dimensions of the cabin and baggage space are 9 feet length and 3 feet 5 inches width, while the height varies from 5 feet 6 inches at the front end to 4 feet 6 inches at the rear of the baggage space. The total available load space in the standard arrangement of cabin and baggage space, is 146 cubic feet.

A cabin heater, taking in clean air heated by the exhaust

pipe, can be installed when desired.

Special luxurious custom made cabin interior finish can also be supplied by arrangement.

### Landing Gear

A very simple landing gear, all steel and of great strength, is fitted (Fig. 6). A wheel track of over 10 feet and yet a simple rugged structure, with short members, are the main features. There is no axle between the wheels, the entire track being unobstructed. The shock absorber rubbers can be quickly removed and replaced cheaply, as a made-up unit. By the special arrangement of these rubber shock absorbers, a long stroke is obtained, which starts at low resistance to deflection, the resistance increasing as the strut compresses further. The wide track, with the high position of the wing tips, gives maximum security against damages from "ground looping," and permits the safe performance of this maneuver when necessary to avoid running into obstacles.

The landing gear is specially designed to permit immediate installation of special wheels with brakes, if desired.

### F l o a t   G e a r

A number of Fokker "Universals" have been equipped with all-metal floats/ (Fig. 1). The attachment of floats does not necessitate any changes in the construction of the airplane as an arrangement for



them is provided. They handle well on the water and in the air; the high position of the wing is especially desirable when docking along a wharf or a bank, as it enables stepping from the cabin directly onto the wharf or vice versa.

### S k i s

As Fokker "Universals" have been extensively used in Canada for winter service, thoroughly proven ski equipment for use on snow or ice can be supplied. These skis are instantly interchangeable with the wheels.

### T a i l    S k i d

The latest development of the Fokker steerable tail skid is fitted. The skid arrangement has given full satisfaction on all the latest types of Fokker military and commercial aircraft (Fig. 4). The skid is made of heat-treated alloy steel tubing and is practically unbreakable. The detachable shoe, consisting of a simple manganese steel casting, is held in place by two bolts. The shock absorbers are rubber rings, easily slipped into place under no tension, and tightened by turning a nut.

The method of steering is novel, and the movement, although very effective, is "irreversible." The result is that there is no tendency to involuntary "ground looping"; taxiing in a cross wind and in a small radius is perfectly easy.

### Tail Surfaces

All tail and control surfaces are of steel tube construction, fabric covered (Fig. 5). The incidence of the stabilizer is adjustable from the pilot's seat. The rudder and elevator are balanced and very effective at all speeds even below the stalling speed.

### Finish

The standard finish is an attractive color scheme in Royal blue lacquer on the fabric-covered parts with black lacquer metal parts. The fabric and doping work conforms to strict specifications. The fuselage cover is laced underneath and especially well supported by several stringers on every side.

The wings are finished in aluminum varnish, but can have natural wood finish if desired. Varnish of the best quality only is used.

### Specifications

#### Dimensions:

Effective wing area . . . . .	330 sq.ft.
Span . . . . .	47 ft. 9 in.
Length . . . . .	33 ft.
Height . . . . .	8 ft. 9 in.

## Specifications (Cont.)

Weights and Load:

Wt. empty, with standard equipment . . . . .	2,100 lb.
Pilot . . . . .	180 lb.
Gasoline (78 gal.) . . . . .	480 "
Oil (5 gal.) . . . . .	40 "
Pay load . . . . .	<u>1,200 "</u>
Total disposable load . . . . .	<u>1,900 lb.</u>
Weight loaded . . . . .	4,000 lb.

Performance with Full Load:

High speed at sea level . . . . .	118 M.P.H.
Cruising speed (1,550 R.P.M.) . . . . .	98 "
Landing speed . . . . .	48 "
Climb - 500 ft. per min. . . . .	10,000 in 40 min.
Service ceiling . . . . .	11,500 ft.
Absolute " . . . . .	12,200 "

Note.— The fully loaded weight above given is that for which the Fokker Universal type is approved by the Department of Commerce. With reduced pay load the performance figures given are, of course, materially improved on.

Wright  
Whirlwind J-5  
engine

Effective  
wing  
area  
330 sq.ft.

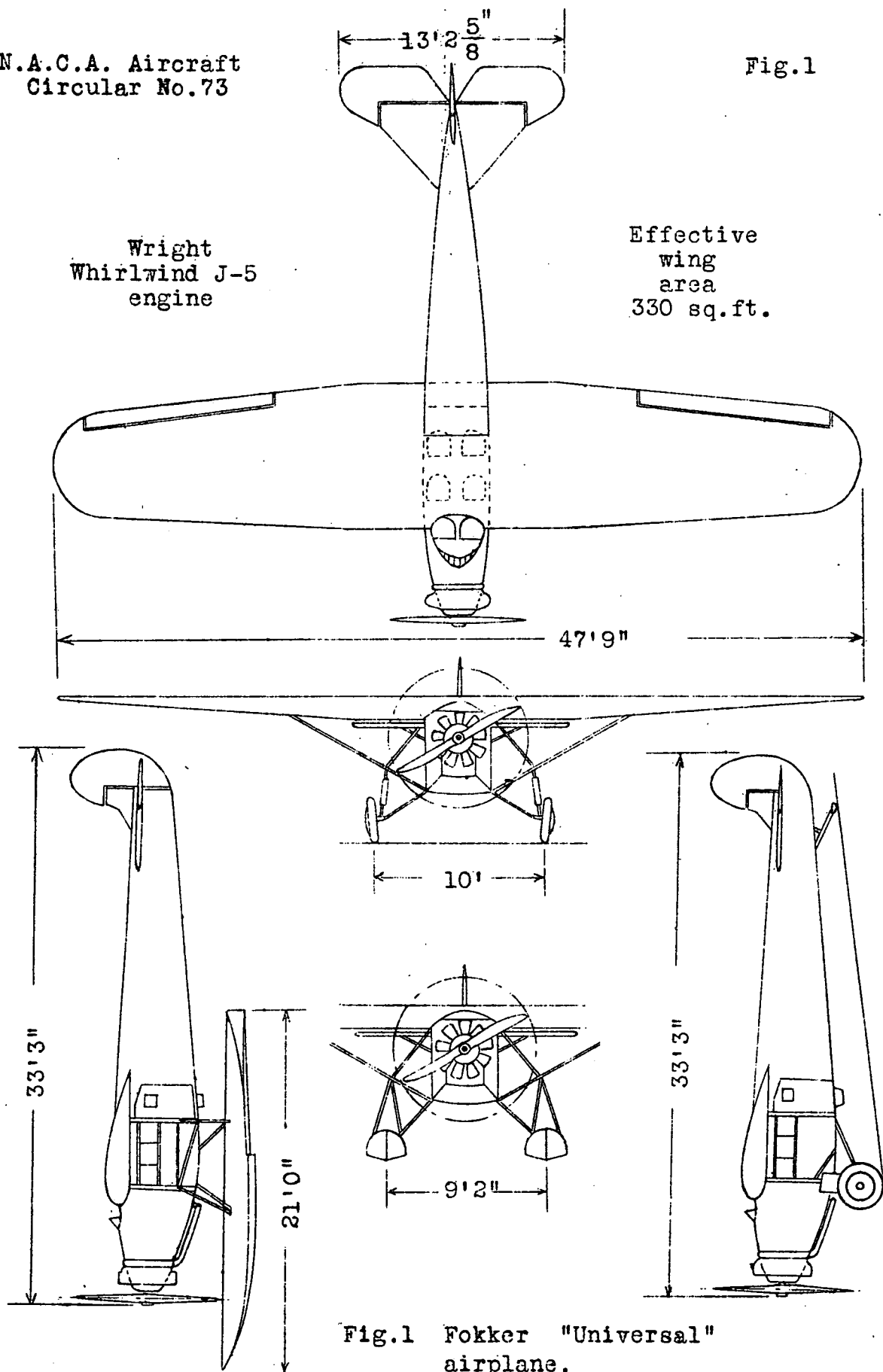


Fig.1 Fokker "Universal"  
airplane.



Fig. 2 Three-quarter front view of the Fokker "Universal" commercial airplane

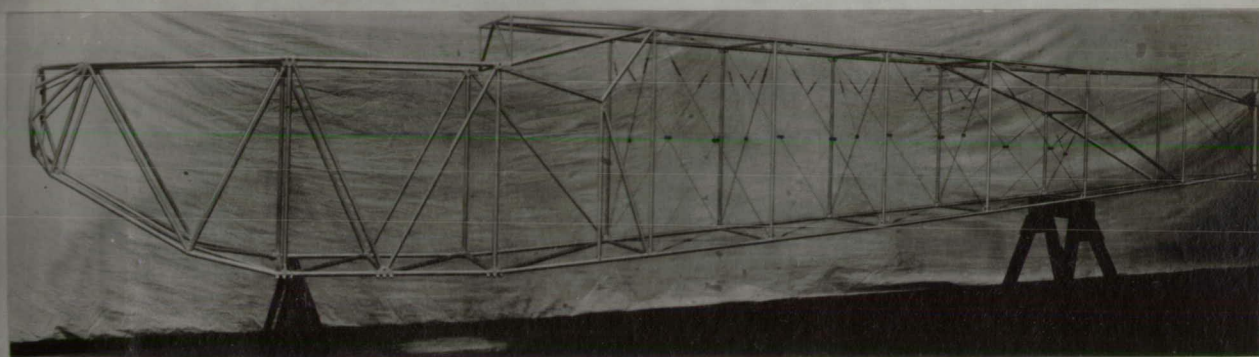


Fig. 3 The steel-tube fuselage framework of the Fokker "Universal".

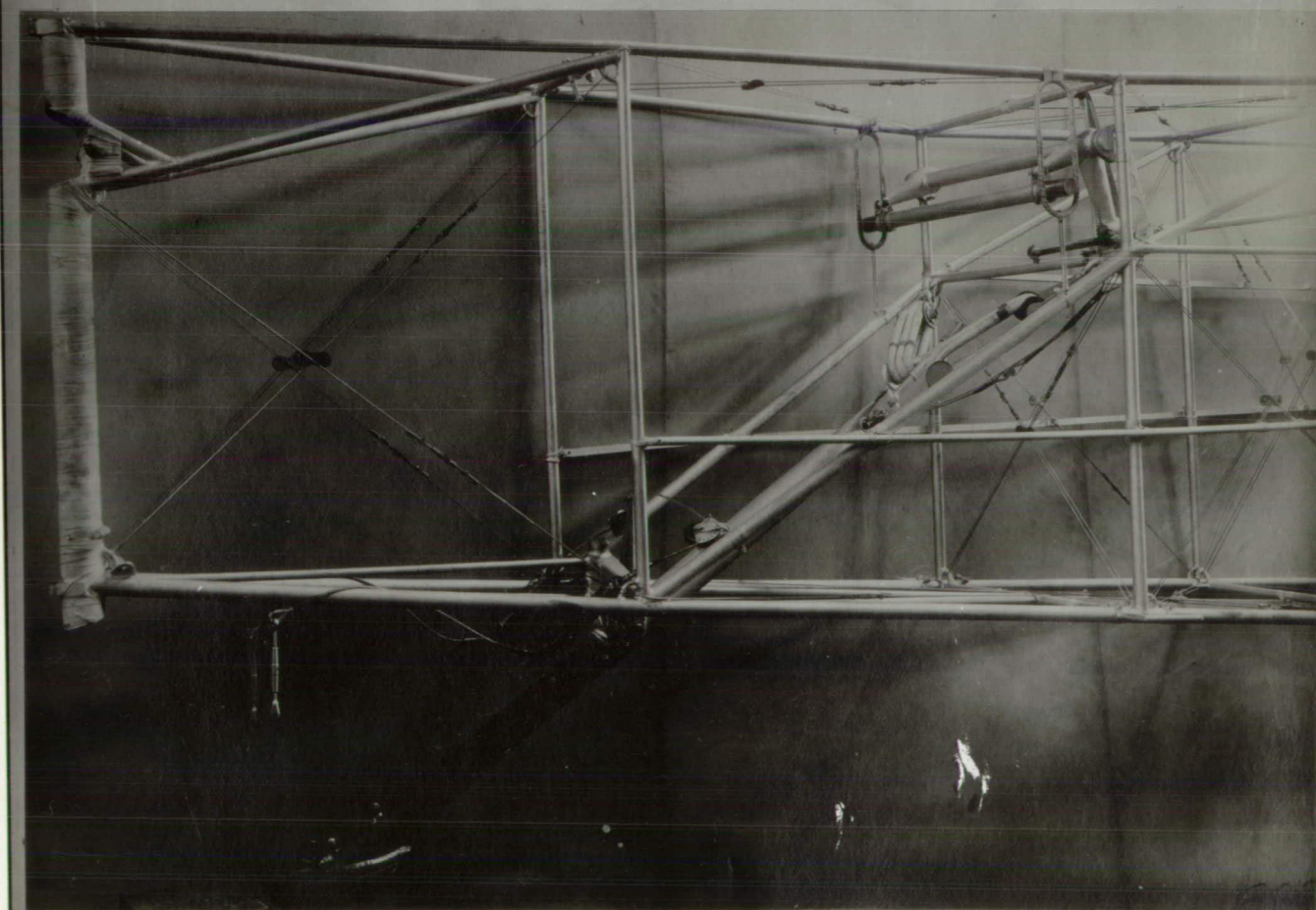


Fig. 4 Enlarged view of the fuselage framework showing stabilizer adjusting device and steerable tail skid for the "Universal" airplane.





Fig.5 Tail surfaces of the "Universal".



Fig.6 Landing gear of the Fokker "Universal" airplane.